PML | Plymouth Marine Laboratory

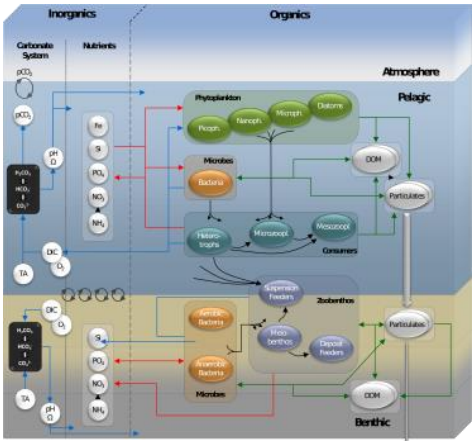
Listen to the ocean

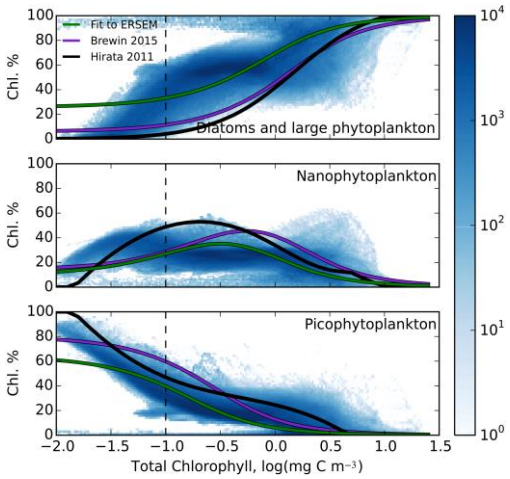
Do marine models need complex ecosystems to make predictions about climate change?

PML Supervisors: Dr Lee de Mora (ledm@pml.ac.uk) & Dr Luca Polimene
Exeter University Supervisor: Dr Tim Lenton (t.m.lenton@exeter.ac.uk)

There is no greater threat to our planet than climate change. The plants and animals living in the ocean are vulnerable to rising temperatures, ocean acidification and marine pollution. Numerical simulations are a critical component of marine science, as they are the only tools available to predict how these factors will influence marine life under a changing climate.

Emergent properties are structures, patterns or relationships that are observed in nature and emerge from sufficiently complex models without being explicitly parameterized. However, complex models are more computationally expensive and so most of the models submitted to the Climate Model Intercomparison Project (CMIP) and to the International Panel of Climate Change (IPCC) use simpler marine models, many of which are not able to reproduce the emergent properties seen in the more expensive fully-featured models like ERSEM (right).





This project will address whether the absence of emergent properties in simpler models impacts the models ability to represent natural ecosystem behaviour and to make predictions about the ecosystem under a changing climate. As an example, phytoplankton form the base of the marine food chain and produce half the oxygen in the atmosphere. Can less complex models produce a natural structure in the relative abundance of phytoplankton size classes (left)? Can models predict how those relationships may change in the future?

Research methodology: These questions will be investigated initially using the GOTM-ERSEM water column model simulating conditions in the Western English Channel. Later, the student would make a 3D simulation in the North Atlantic or Global Ocean domain.

We are looking for a candidate with either a master's degree in oceanography or similar with a proven track record of numerical modelling; or a master's degree in a mathematically or computationally intensive field, such as physics, chemistry, mathematics, or engineering, with a demonstrable interest in marine or climate research. This project will be based at PML, with one of the largest and most distinguished marine ecosystem modelling groups in the world. Throughout this project, the student will develop the tools needed to pursue a career in marine research. They will learn how to develop, run and evaluate models of the environment, test hypotheses, publish results, and present research at conferences.